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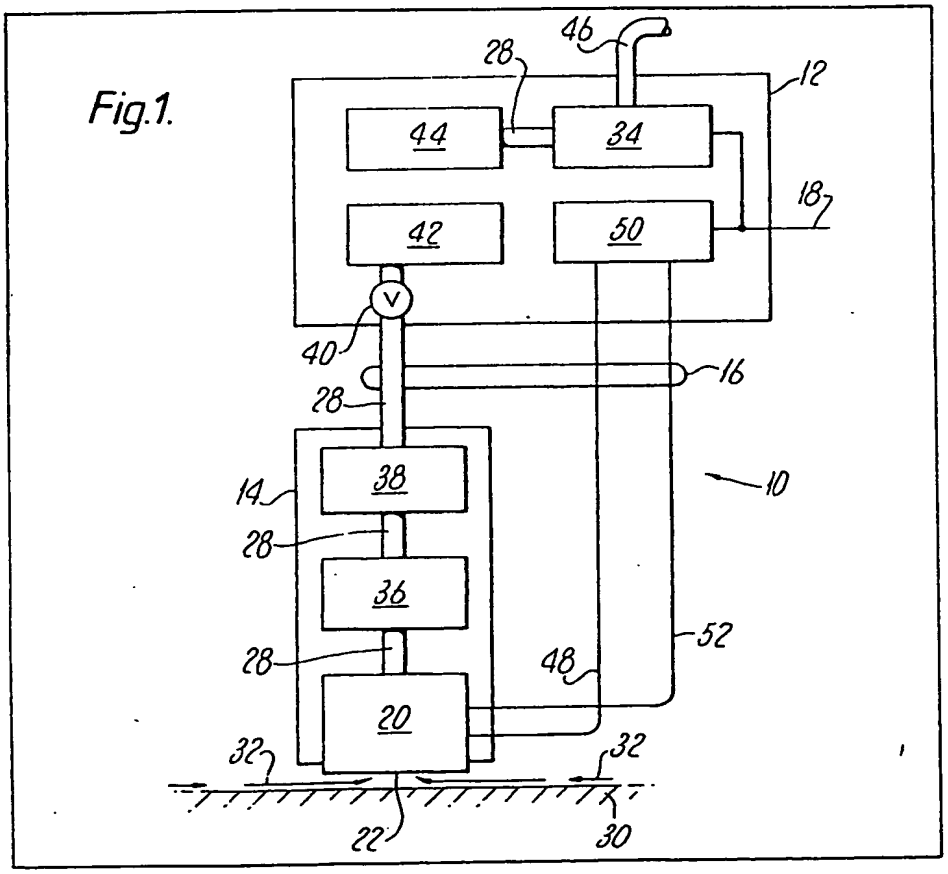
(54) Apparatus for collection of sorbed substances

(57) The apparatus has an electrically heated block 20, with a temperature control; means 34 for drawing a current of air 32 over a grooved contact surface of the block; trap means 38 for absorbing from the current of air substances in vapour form entrained there-with; and means 42 for measuring the flow rate of the current of air. Condenser 36 may also be provided for condensing moisture from the air before it reaches the absorbing means. In use block 20 is placed in contact with surface 30 on which the sorbed substance is deposited.

The apparatus may be portable so as to be applied to recover sorbed substances from e.g. floor and upholstery surfaces, especially for forensic purposes and in tracing environmental health hazards.

Fig.1.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

Fig.1.

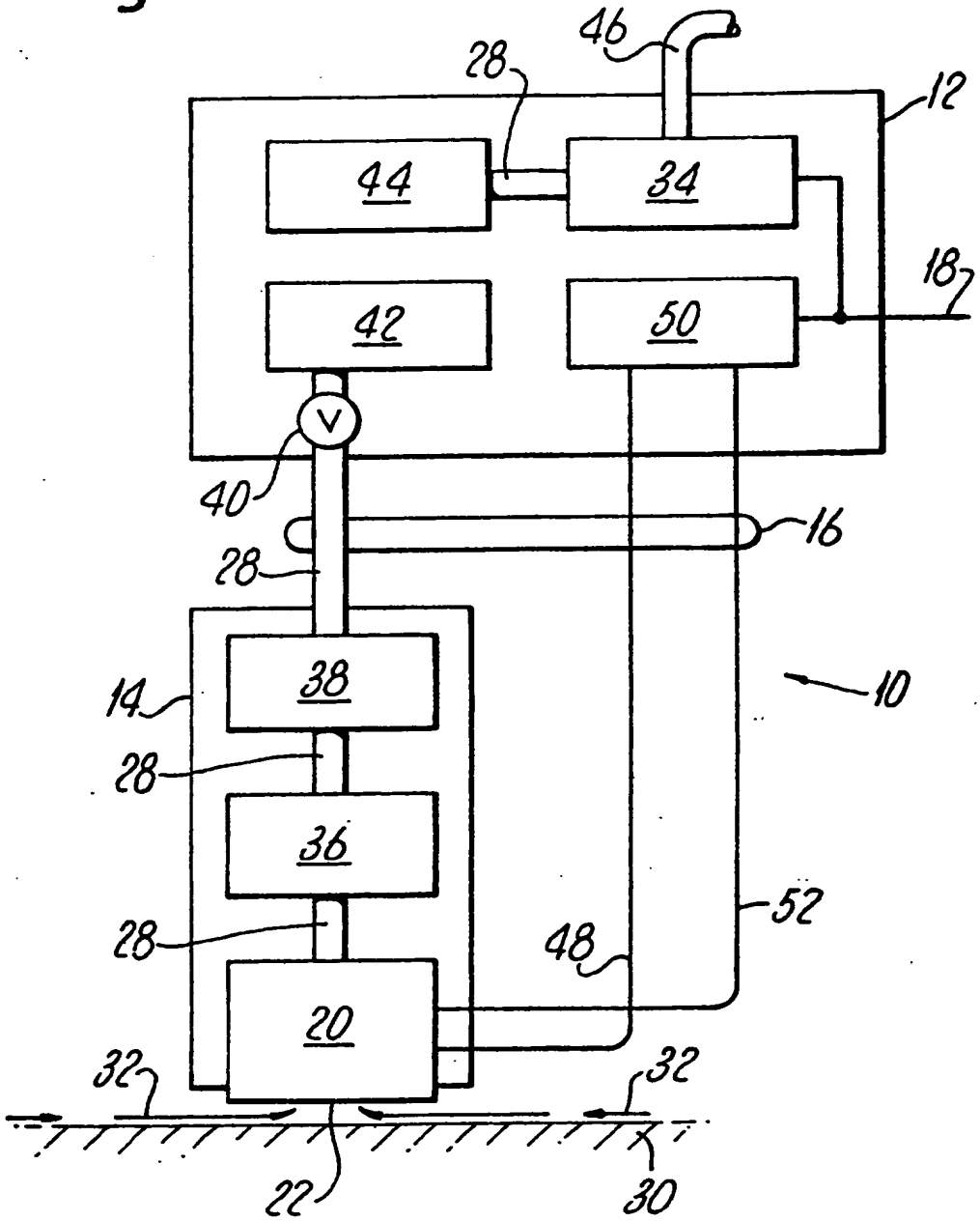


Fig.2.

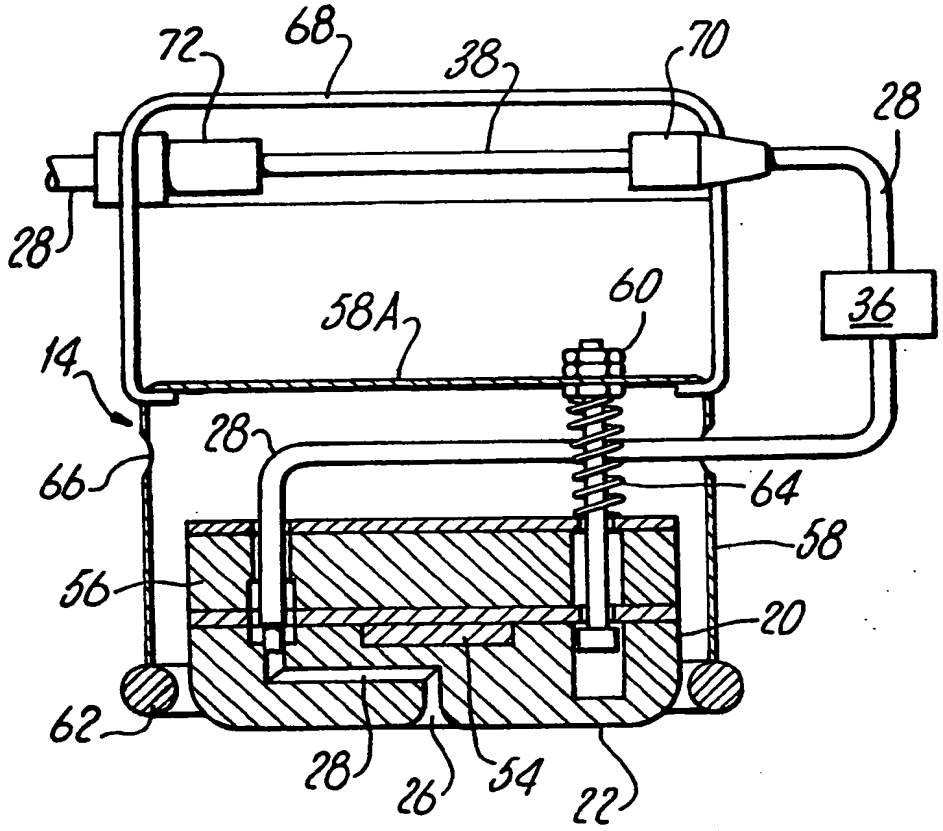
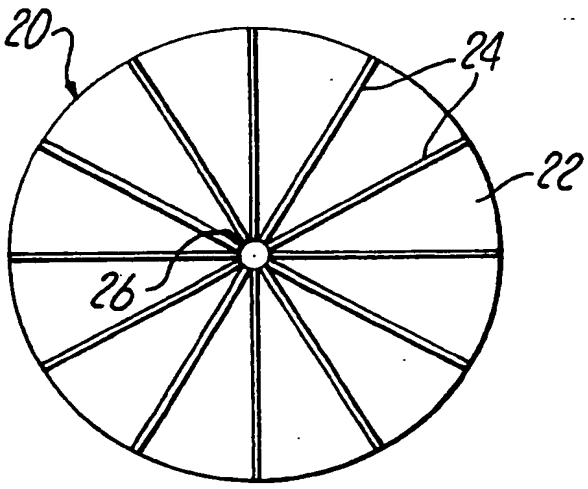


Fig.3.



SPECIFICATION

Improvements in or relating to collection of sorbed substances

This invention relates to apparatus for collection of sorbed substances, more especially volatile substances sorbed in or on a material surface in small or very small areal concentrations.

The invention finds application, for example, in investigations in the forensic and environmental health fields, and may be used for detecting the presence of small quantities of drugs, anaesthetics, cleaning fluids, organic solvents and the like potentially hazardous volatile substances where they may have been spilled, e.g. on floor coverings, clothing or the upholstery or lining of a vehicle.

It has been usual to detect such substances by swabbing with a known solvent, in the case of large articles under investigation, and then analysing the swab in a laboratory. This has the disadvantage of requiring great care and experience on the part of the investigator carrying out the swabbing operation, and results may be variable and lacking in reliability. Only very small samples can, in general, be investigated directly in a laboratory.

The present invention allows large areas to be investigated, and objects which it is not practicable to transport to a laboratory. It also allows consistent results to be obtained without the need for great care and experience in collecting a sample.

According to the invention, apparatus for collection of sorbed substances has contact heating means; leading from a contact surface thereof, duct means connecting to sorption trap means and pump means in series; whereby, in use, when the contact heating means is applied to a material surface, air is drawn by the pump means between said contact surface and the material surface and through the duct and sorption trap means, and any sorbed substances released from the material are collected by the sorption trap means.

The contact heating means preferably includes an electric heating element. An air flow meter may be provided in series with the sorption trap means; and a water vapour condenser may be provided in series with the sorption trap means, upstream thereof.

The contact heating means is preferably constructed to include a heated block incorporating the contact surface which has grooves therein through which air can be drawn into the duct means; the contact surface of the block being at least predominantly, flat. Conveniently the block is cylindrical, the contact surface then being circular with radial grooves.

The contact heating means may include a shroud arranged peripherally of the block so that, in use, air approaches the interface between the block and the material surface substantially along the material surface.

The block is conveniently spring mounted in the contact heating means, so that when, in use, the shroud touches the material surface the contact face of the block is held in contact with the material surface by a predeterminable force.

Preferably the heating of the contact heating means is thermostatically controlled; and the contact heating means is conveniently provided with a handle, and is adapted to be movable independently of at least some other parts of the apparatus.

The invention will be further described, by way of example only, with reference to the accompanying drawings in which

Fig. 1 is a general block diagram of an apparatus for collection of sorbed substances

Fig. 2 is a part sectional elevation of a hand-held contact heating means

Fig. 3 is a plan of the contact surface of a block part of the contact heating means.

Referring to Fig. 1, the apparatus for collection of sorbed substances, indicated generally by 10, comprises two units. The control unit is indicated by box 12, and the contact heating means by box 14, the two units being connected by electrical leads and duct means carried in a single flexible conduit indicated by 16. Power supplies are provided to the control unit 12 through a mains lead 18.

The contact heating means 14 comprises a cylindrical heated block 20, the base 22 of which is provided with radial grooves 24 (Fig. 3) leading to the central opening 26 to a duct 28 (Fig. 2). In use, the heated block is placed in contact with a material surface 30 which is to be investigated. The material is heated by contact with the block and volatile substances sorbed or on near to the material surface are vapourised. The vapour of the volatile substances is entrained by a flow of air, indicated by the arrows 32, and swept into the duct 28 by the action of the pump 34. Air having entered the duct 28 passes first to a water vapour condenser 36, which arrests substantially all water vapour carried in with the air. It is, however, to be understood that provision of the condenser 36 is optional and may only be needed if ambient conditions are very damp. Air, with vapour of any volatile substance from the material, passes next to sorption trap means 38. The sorption trap means is made to be readily detachable from between flexible sections of the duct 28. The trap includes a sorbing substance which takes up substantially all the vapour of any volatile substance borne that far by the flow of air.

From the sorption trap means 38, air passes through a further length of the duct 28 and a flow control and stop valve 40 to an air flow meter 42. Air passes next through the filter 44, which removes any abrasive or other damaging substance, which might be carried by the air flow, before it can reach the pump 34. The air is finally discharged at the outlet 46.

Electric power for heating the block 20 is supplied to an electric heating element therein, through leads indicated by 48, from a temperature controller 50, which is preferably of the adjustable

kind. The temperature controller is actuated by a thermocouple inserted in the block 20, and connected to the temperature controller 50 through leads 52.

The contact heating means is illustrated in more detail in Fig. 2. The block 20 is provided with a heater 54, placed substantially centrally. The side of the block 20 on which the heater is fixed is preferably provided with a layer 56 of heat insulating material. The block 20 is surrounded by a cylindrical shroud 58, closed at the upper end (as illustrated) by a plate 58A. The block 20 is supported in the shroud 58, 58A by four spring loaded studs 60, only one of which is illustrated. With the springs in the uncompressed state, the contact surface 22 of the block stands proud of the rim 62 of the shroud 58. When the contact heating means is applied to a material surface under investigation, the springs 64 are compressed until the rim 62 touches the surface. No increased force can then be exerted on the surface by the block 20. The force can be adjusted, e.g. through the initial compression of the springs. On some material surfaces, the application of the rim 62 might excessively restrict access of air to the contact surface 22. To guard against this the shroud may be provided with ventilation holes such as that indicated at 66. The contact heating means is conveniently moved around, and applied, by means of a handle 68. The handle may conveniently be arranged to form, in use, a protection for the sorption trap means. The sorption trap means is conveniently a length of glass tube containing sorbing substance, insertable into the duct 28 between flexible connections 70, 72. In Fig. 2, the condenser 36 is shown in a diagrammatic manner only, since it is an optional item. Although the term "condenser" has been used, the function may be performed by a tube, similar to 38, but containing a water absorbing substance.

The contact surface 22 is predominantly flat, but the edges are conveniently rounded off to limit marking of material surfaces to which the contact heating means may be applied. The block is made of aluminium or aluminium alloy for lightness, and a convenient diameter is of the order of 100 mm. For this size, a heater power in the range of 80 to 200 watt, preferably about 125 watt, is suitable; and a temperature at the surface 22 in the range 80 to 120° can be maintained. A suitable kind of electric heating element is of the kind commonly used in soldering irons. A chromel/alumel thermocouple is suitable for sensing the temperature of the block 20, and a suitable temperature controller is, by way of example, one available under the name 'Ministat' (RTM). The sorbing substance in the sorption trap 38 is conveniently an organic polymeric substance available under the name Tenax (RTM).

The air flow meter 42 conveniently measures flows up to about 1 litre per minute, and may be of the kind available under the name "Rotameter" (RTM). The pump 34 may be one of a number of proprietary kinds which can deliver a steady flow of up to about 1 litre per minute and exert a pressure of up to about 3000 N per square metre. The duct 28, is preferably made of polytetrafluoroethylene tube of about 1.5 mm bore.

CLAIMS

1. Apparatus for collection of sorbed substances, having contact heating means; leading from a contact surface thereof, duct means connecting to sorption trap means and pump means in series; whereby, in use, when the contact heating means is applied to a material surface, air is drawn by the pump means between said contact surface and the material surface and through the duct and sorption trap means, and any sorbed substances released from the material are collected by the sorption trap means from the air.

2. Apparatus according to claim 1 in which the contact heating means includes an electric heating element.

3. Apparatus according to claim 1 or claim 2 in which an air flow meter is in series with the sorption trap means.

4. Apparatus according to any one of the preceding claims in which a water vapour condenser is in series with the sorption trap means, upstream thereof.

5. Apparatus according to any one of the preceding claims in which the contact heating means includes a heated block, incorporating the contact surface, which has grooves therein through which air can be drawn into the duct means.

6. Apparatus according to claim 5 in which the contact surface of the block is at least predominantly flat.

7. Apparatus according to claim 5 or claim 6 in which the block is cylindrical, and the contact surface is circular with radial grooves.

8. Apparatus according to any one of claims 5 to 7 in which the contact heating means includes a shroud arranged peripherally of the block so that, in use, air approaches the interface between the block and the material surface substantially along the material surface.

9. Apparatus according to claim 8 in which the block is spring mounted in the contact heating means, so that when, in use, the shroud touches the material surface the contact face of the block is held in contact with the material surface by a predetermined force.

10. Apparatus according to any one of the preceding claims in which the heating of the contact heating means is thermostatically controlled.

11. Apparatus according to any one of the

preceding claims in which the contact heating means is provided with a handle, and is adapted to be movable independently of at least some other parts of the apparatus.

12. Apparatus for collection of sorbed substances, substantially as hereinbefore described with reference to any one of the accompanying drawings.

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